IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

SINGULAR COMPUTING LLC, Plaintiff, v. GOOGLE LLC, Defendant.	C.A. No. 1:19-cv-12551-FDS Hon. F. Dennis Saylor IV

DEFENDANT GOOGLE LLC'S MEMORANDUM IN SUPPORT OF ITS MOTION TO EXCLUDE CERTAIN OPINION TESTIMONY OF PHILIP GREEN

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Plaintiff Singular Computing ("Singular")'s damages expert Philip Green claims that, in 2017, Google would have agreed to pay Singular, a company without a commercially viable product and which had achieved no commercial success, up to [redacted] for a license to U.S. Patent Nos. 8,407,273 ("the '273 Patent") and 9,218,156 ("the '156 Patent"). For multiple, independent reasons, Mr. Green's damages opinions fail to meet "the essential requirement for reliability under *Daubert*" that "the ultimate reasonable royalty award [] be based on ***the incremental value that the patented invention adds to the end product.***" *Commonwealth Sci. & Indus. Rsch. Org. v. Cisco Sys., Inc.*, 809 F.3d 1295, 1301 (Fed. Cir. 2015) (emphasis added).

First, Mr. Green's cost-savings damages opinions are untethered to the smallest salable patent practicing unit: the TPUv2 and v3 *chips*. Mr. Green's royalty base instead relies on alleged cost savings attributable to the TPU *system* as a whole. His analyses thus violate the entire market value rule and are impermissibly inflated to as much as [redacted]. ***Second***, Mr. Green compounds this error by relying on two flawed analyses to construct his apportionment rates. ***Third***, Mr. Green improperly assumes that *all* cost savings would go to Singular in a hypothetical negotiation, contrary to basic economics. ***Fourth*****,** rather than offer a specific damages number, Mr. Green plans to testify that Google would have paid anywhere between [redacted] for a license to the Asserted Patents—a range that is highly speculative, prejudicial, and unhelpful to the jury. ***Finally,*** Mr. Green opines on various topics that are unrelated to his damages computation and outside the scope of permissible expert testimony.

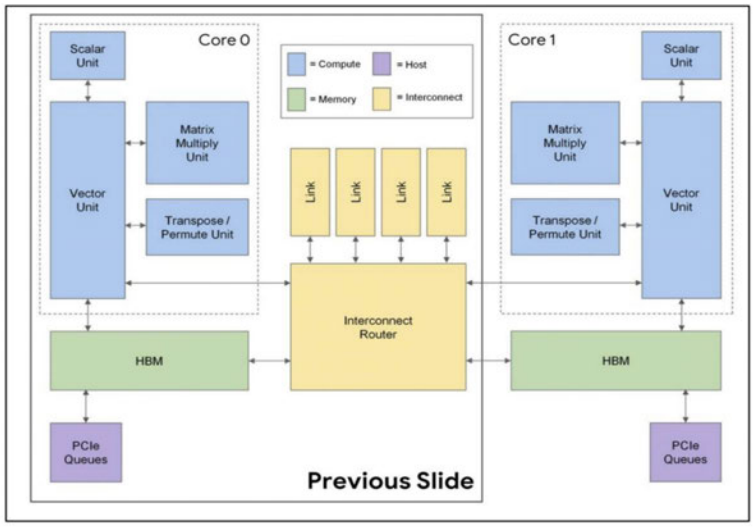
For all of these reasons and as explained further below, these issues render Mr. Green's opinion unreliable, irrelevant, and misleading, and his opinion should be excluded in its entirety.

I. BACKGROUND

Google's TPU Systems and Chips: Google designed its Tensor Processing Unit

("TPU") systems—sometimes referred to as "accelerators"—to accelerate computing tasks related to machine learning. Although there are multiple versions of Google's TPU systems, Singular accuses sub-components of just two TPU systems of infringement: TPUv2 (i.e., "Jellyfish") and TPUv3 (i.e., "Dragonfish"). These TPU systems consist of multiple TPU chips plus many other non-accused components and software.

While Singular's infringement allegations target functionality specific to subparts of the TPU *chips*, Mr. Green's analysis focuses on TPU *systems* as a whole. Under Singular's infringement theory, the limitations of the Asserted Claims are allegedly infringed by only sub-components of the TPU chips. *See* Declaration of Michelle Ybarra ("Ybarra Decl.") Ex. B ("Khatri Rpt.") at ¶¶ 78-83, 90-96, 240; *see infra* Section III.A. As shown in the following diagram of a TPUv2 chip, each TPUv2 chip contains two "Tensor Cores," labeled Core 0 and Core 1 (in the dashed line box with sub-components shown in blue):

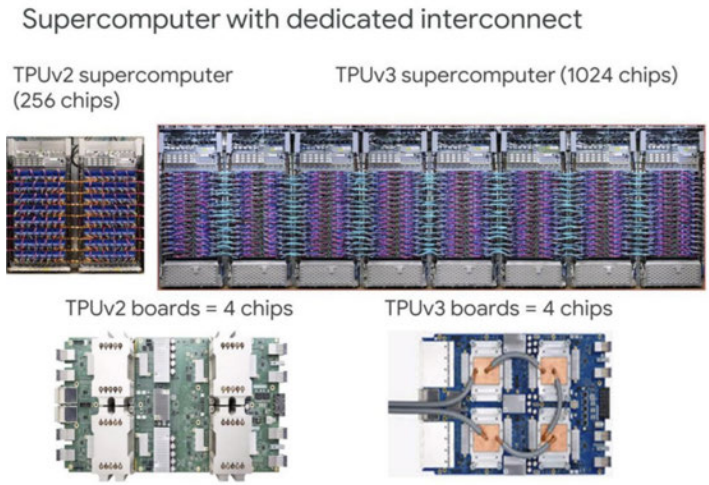


Ybarra Decl. Ex. C (GOOG-SING-00027590) at 617 ("Fig. 1").

Each Tensor Core itself contains several distinct components, including one "Matrix Multiply Unit" (MXU) that performs arithmetic to carry out "matrix multiplication" on 16-bit floating point values in the "bfloat16" (BF16) format. Khatri Rpt. at ¶ 102; *see supra* Fig. 1.

Each TPUv2 chip contains 2 total MXUs—one in each TensorCore. The TPUv3 chip is structurally similar to the TPUv2 chip depicted above but has twice as many MXUs. *Id.* at ¶ 95.

A [redacted] to run typical machine-learning workloads; thus, Google designed its TPU systems to be networked so that multiple chips could work "in conjunction." *See* Ybarra Decl. Ex. C at 648. Four TPUv2 chips form a TPU board; but Google does not typically use individual TPU boards for machine learning. Instead, Google combines TPU boards to form scaled TPU *systems* of between 16 and 1,024 TPU chips:



Id. at 652 ("Figure 2"). As shown above, each TPU chip and system contains many components beyond the MXU and Tensor Cores, including interconnects and interconnect routers that allow undelayed inter-chip communication. There is no dispute that interconnects—along with many other physical components and software related to both TPU chips and systems—are unrelated to the asserted claims and reflect Google's non-accused contributions to the TPU system and chips.

The '273 and '156 Patents: Now that Singular's other claims have been held invalid by the PTAB, Singular accuses Google of infringing only claim 53 of the '273 patent and claim 7 of the '156 patent (the "Asserted Claims"). Ybarra Decl. Ex. A ("Green Rpt.") at 18-21. The Asserted Claims include substantively identical limitations. They depend from unpatentable

independent claims that cover a computing device that includes "execution units" that perform arithmetic operations on inputs with "high dynamic range." The execution units perform a "first operation" in such a way as to introduce some minimum amount of error for some minimum percentage of valid inputs. The patents call such execution units "LPHDR execution units." The remaining Asserted Claims both contribute the same purportedly novel limitation: that the number of LPHDR execution units in the device "exceeds by at least one hundred" the number of execution units in a device adapted to perform multiplication using 32-bit inputs (*i.e.*, traditional or single-precision execution units) (the "exceeds limitation"). The PTAB's 2022 IPR rulings found that the prior art disclosed the LPHDR execution units, as claimed in the independent claims from which the Asserted Claims depend. *See* Google's concurrently-filed Motion to Exclude Testimony of Dr. Khatri at 9-11 ("Khatri *Daubert*").

Singular's Damages Theory: Singular's damages calculations are based on a reasonable royalty analysis under a hypothetical negotiation construct. Green Rpt. at 6. Mr. Green assumes that if Google wanted to use Singular's technology, Google and Singular would have engaged in a hypothetical negotiation in March 2017 focused on specific "quantitative indicators," primarily Google's incremental "cost savings" attributable to the use of the TPU systems[1] instead of alternative third-party graphics processing unit ("GPU") systems. Green Rpt. at 63.[2]

Mr. Green assumes that, if Google had been unable to use the allegedly infringing functionality in the TPU systems, Google would have stopped using TPU systems entirely and

[1] Mr. Green claims that these were the "quantitative indicators" of the "benefits that Google expected to, and has achieved, from the use of Singular's patented technology." Green Rpt. at 63. Mr. Green proffers two damages opinions. He refers to one as "cost savings" and the other as "excess returns." As both are based on cost savings, this motion refers to both using that term.
[2] Mr. Green also analyzes a third "quantitative indicator," the potential profits associated with TPUs. But Mr. Green refuses to identify a damages number for this analysis. *Id.* at 83, 112.

instead would have purchased GPU systems developed by Nvidia. Green Rpt., Section V.C. Mr. Green opines that, at the time of the hypothetical negotiation, the parties would have considered four types of cost savings that Google purportedly achieved by using Singular's technology in its TPU chips, resulting in a royalty base of as much as [redacted]:

- TPU System Savings: Mr. Green uses performance-related metrics to compare TPU systems and GPU systems and claims that, without being able to use the TPU chip, Google would have had to pay more to purchase the number of GPU chips needed to obtain an equivalent performance level. Mr. Green estimates that Google saved approximately [redacted] on this metric alone. *See* Green Rpt. at Section V.C.1; Green Rpt. Ex. C.
- Data Center Construction Savings: Based on his system-level comparison of TPUs to GPUs, Mr. Green claims that, if Google were not able to use the TPU chips, Google would have had to build "[redacted]" to deploy enough GPU chips to match the TPU chips' performance, thereby saving Google approximately [redacted] in data center construction costs. *Id.*
- Ongoing Operating Expenses: Mr. Green claims that, if the TPU chips were unavailable, Google would have incurred approximately [redacted] in additional overhead expenses to operate the additional data centers running GPUs instead of TPUs. *Id.*
- Ongoing Electricity Expenses: Mr. Green claims that Google saved approximately [redacted] in electricity expenses by using TPU systems instead of GPU systems. *Id.*

Mr. Green further opines, based on either his own "accounting apportionment" or Dr. Khatri's "technical apportionment," that a range of approximately 23%−40% of the cost benefits of the TPU systems should be attributed to the patents-in-suit. *See, e.g.,* Green Rpt. at 107. Thus, Mr Green concludes the reasonable royalty owed by Google to Singular would be **between** [redacted]. *Id.* at 105; *see also* Ybarra Decl. Ex. D ("Green Tr.") at 49:5-12.

II. LEGAL STANDARD

Under Rule 702, "district courts considering the admissibility of expert testimony must 'act as gatekeepers, ensuring that an expert's proffered testimony both rests on a reliable foundation and is relevant to the task at hand.'" *SiOnyx, LLC v. Hamamatsu Photonics K.K.*, 15-cv-13488, 2019 WL 13180450, at *1 (D. Mass. April 18, 2019) (Saylor, J.) (citing *Samaan v. St. Joseph Hosp.*, 670 F.3d 21, 31 (1st Cir. 2012)). "The ultimate purpose of the *Daubert* inquiry is

to determine whether the testimony of the expert would be helpful to the jury in resolving a fact in issue." *Cipollone v. Yale Indus. Prods., Inc.*, 202 F.3d 376, 380 (1st Cir. 2000).

To be admissible under *Daubert* and Rule 702, expert testimony must: (i) be based on specialized knowledge, training, or experience that will assist the trier of fact; (ii) be based on sufficient facts or data; (iii) be the product of reliable principles and methods; and (iv) reliably apply the principles and methods to the facts of the case. Fed. R. Evid. 702. "[A]ny step that renders the [expert's] analysis unreliable under the *Daubert* factors renders the expert's testimony inadmissible." *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 745 (3d Cir. 1994)). Because expert testimony "can carry with it an unwarranted aura of special reliability and trustworthiness," *United States v. Pires*, 642 F.3d 1, 12 (1st Cir. 2011), even testimony otherwise admissible under Rule 702 "may nonetheless be excluded if it is likely to be misinterpreted or misused by the jury." *SiOnyx*, 2019 WL 13180450 at *1 (citing Fed. R. Evid. 403). Singular bears the burden of establishing that Mr. Green's testimony is both reliable and relevant. *See Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1324-25 (Fed. Cir. 2009)

III. ARGUMENT

A. Mr. Green improperly uses the entire market value for his royalty base.

Federal Circuit law is clear: where an accused product contains multiple components, allowing an expert to present a royalty based on the value of the entire product is reversible error unless the patented feature is shown to create the basis for the accused product's demand. Mr. Green derives his proposed royalty base from the value of TPU systems, but he does not–and cannot–show that the patented feature drives demand. His opinions must be excluded.

"[W]here multi-component products are involved . . . the ultimate combination of royalty base and royalty rate must reflect the value attributable to the infringing features of the product, and no more." *Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201, 1226 (Fed. Cir. 2014). Thus,

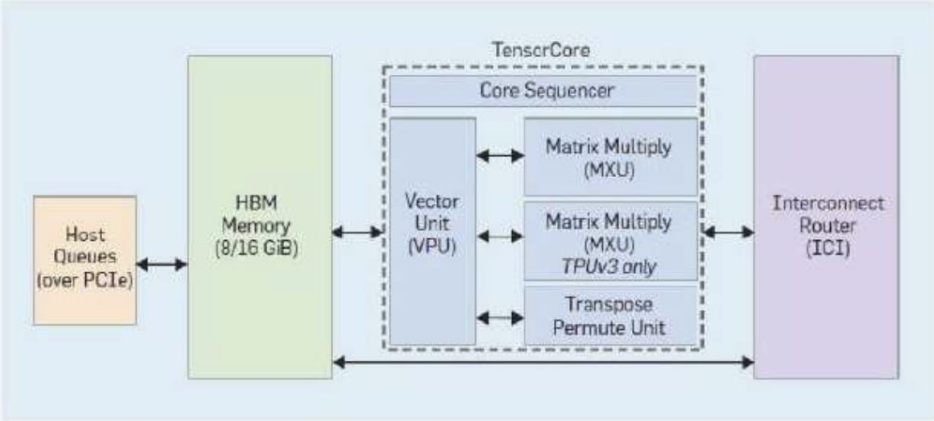
where, as here, multi-component products are accused of infringement, "it is generally required that royalties be based not on the entire product, but instead on the 'smallest salable patent-practicing unit'" ("SSPPU"). *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 67 (Fed. Cir. 2012); *Uniloc USA. Inc. v. Microsoft Corp.*, 632 F.3d 1292, at 1318-20 (Fed. Cir. 2011); *Microchip Tech. v. Aptiv Servs.*, No. 1:17-cv-01194- JDW, 2020 WL 5203600, at *6 (D. Del. Sept. 1, 2020) (applying SSPPU requirement to royalties based on a cost-savings approach). Conversely, "[a] patentee may assess damages based on the entire market value of the accused product *only* where the patented feature creates the basis for customer demand or substantially creates the value of the component parts." *Versata Software, Inc. v. SAP Am., Inc.*, 717 F.3d 1255, 1268 (Fed. Cir. 2013) (emphasis added).

The SSPPU here is at most the TPUv2 or TPUv3 ***chip***. Under Singular's infringement theory, the relevant limitations of the Asserted Claims involve only sub-components of the TPU chips.[3] Specifically, Dr. Khatri concedes that "the accused TPUv2 and TPUv3 devices comprise at least one VPU, at least one MXU, and at least one Core Sequencer[, and] . . . **each and every limitation of claim 7 is met by various circuits contained within—and/or shared among—these three modules**."[4] Khatri Rpt. at ¶ 96 (emphasis added); *see also id*. at ¶ 240 (opining that "the accused TPUv2 and TPUv3 products . . . also meet each and every limitation of claim 53 of the '273 patent" for the same reasons). As the Tensor Core diagram below shows, the three

[3] Because TPU chips include many unpatented and unpatentable features, Dr. Khatri's own analysis raises a question of whether a unit even smaller than the chip may be the SSPPU. The Court need not reach that question here, because the system-level analysis that Dr. Khatri and Mr. Green perform certainly is not the SSPPU under Singular's own infringement theory.

[4] Dr. Khatri himself is not clear on what he contends the SSPPU should be. Although his analysis involves only sub-chip components, he uses a 4-chip board for his infringement analysis, and then uses systems of 16 or 128 chips as a starting point for his apportionment analysis. But Singular's attempts to shift the SSPPU are irrelevant; the appropriate determination of the SSPPU is tied to the claims and the accused components at the sub-chip level (not Dr. Khatri's unexplained decision to perform any portion of his analysis at the board level).

modules that Dr. Khatri references—the VPU, the MXU, and the Core Sequencer—all exist inside the Tensor Core, i.e., at the sub-chip level.



Khatri Rpt. at ¶ 78 (taken from GOOG-SING-00235971 at 73); *supra* Fig. 1. In other words, under Singular's infringement theory, "each and every limitation" of both Asserted Claims is met by a subset of the components found on a TPUv2 or TPUv3 chip. Thus, **at most**, the TPU chips (or a sub-component) are the appropriate SSPPU. Nevertheless, Mr. Green improperly derives his royalty base from cost savings allegedly attributable to the use of Google's TPU *systems*. This opinion is contrary to the black letter law above on at least three scores.

First, Mr. Green concedes that TPU *systems* contain multiple components, most of which are not accused of infringement. For instance, they "include[], beside the chips, other things, like the interconnects," which are used for scaling and networking *between* TPU chips and are not covered by the claimed invention. Green Tr. at 169:12-19. The existence of significant, additional non-accused features at the system level confirm that the appropriate SSPPU is not broader than the TPUv2 or TPUv3 ***chip***.[5] Nevertheless, Mr. Green's damages opinions are based on purported cost savings derived from the use of TPU *systems*.

[5] Mr. Green deliberately avoids stating whether his proffered royalty base is premised on the "entire market value." *See, e.g.*, Green Rpt. at 62 (citing Entire Market Value Rule without saying whether the rule is used in his report). But throughout his report, Mr. Green refers to the

Specifically, Mr. Green's cost-savings analysis directly compares the costs associated with using Google's TPU *systems* to the costs associated with using non-infringing GPU *systems*, rather than chips. *See, e.g.,* Green Rpt., Ex. K (using 16-chip TPU systems for each multiplier comparing GPU systems to TPU systems); Exhibit D-2 (using a system-based multiplier to calculate cost savings). Indeed, he testified during his deposition that he believes the SSPPU was at minimum a 4-chip TPU ***system***, as opposed to a TPUv2 or v3 ***chip***. *See* Green Tr. at 174:8-24 (testifying that "the smallest saleable unit would be the tray [TPU v3] or the tray [TPU v2]" with four processors in each). But, as explained below, Mr. Green's focus on the full system instead of the actual SSPPU—the TPU chip—inflates the value of the Asserted Claims by crediting those claims with the significant benefits Google derives from the use of non-accused TPU system features.[6]

Second, although Mr. Green's analysis—and [redacted] royalty base—focuses on TPU systems, he has done nothing to establish that a damages model based on the "entire market value" of TPU systems is appropriate—i.e., that "the patented feature creates the basis for customer demand or substantially creates the value of the component parts" for TPU systems as a whole. *Versata*, 717 F.3d at 1268. Nor can he. The relevant standard is exacting: "[I]t is not enough to merely show that the patented feature is viewed as essential, that a product would not be commercially viable without the patented feature, or that consumers would not purchase the

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Accused Products as the "Accused TPUs," which he defines as Google's TPU v2 and v3 "accelerators," a broader set of components than just the TPU chips. *See, e.g.*, *Id*. at 3.

[6] Singular's data-center expert Phil Isaak testified that an analysis based on system-level information "includes things outside of the chip by definition," and that his own analyses focused on use chip-level comparisons because TPU systems include "components other than just the chip," including "the host and other miscellaneous rack loads that aren't included in the chip." Ybarra Decl. Ex. F ("Isaak Tr.") at 143:12-149:6; 289:20-23.

product without the patented feature." *Power Integrations*, 904 F.3d at 979. Rather, "the patentee must prove that those other features do not cause consumers to purchase the product." *Id.* Mr. Green makes no effort to satisfy this standard, or to establish how the accused intra-chip functionality creates cost-savings attributable to TPU systems as a whole.

Mr. Green's report is silent on this score. At deposition, Mr. Green's only explanation for this conclusion was that TPU "chips are being run in systems and they're being run at scale." *Id.* at 171:3-13. But his explanation is a *non sequitur* for purposes of determining the proper royalty base, as the use of an accused component in a larger system does not render that system the SSPPU. Moreover, the record is clear: the vast majority of the value of Google's TPUv2 and TPUv3 systems is derived from *unaccused* features and functionalities. Scaling through interconnects provides a telling example. As mentioned above, a "[redacted]" to run typical machine-learning workloads; thus, Google designed its TPU systems to be networked through Google's custom-designed interconnects so that multiple chips could work "in conjunction," thus allowing for parallel scaling. *See* Ybarra Decl. Ex. C at 648. Google's own documents explain that a "[redacted]" *See, e.g.*, Ybarra Decl. Ex. H at 449. Put differently, significant value of the TPU *systems* as compared to its alternatives is attributable to a feature that is unaccused and functions found only in TPU *systems*, not at the chip level. This fact is impossible to square with Mr. Green's decision to use a royalty base derived from TPU systems. Mr. Green's failure to use cost savings attributable to the SSPPU—the TPU *chip*, or possibly component(s) within the chip—"cannot help but skew the damages horizon for the jury, regardless of the contribution of the patented component." *Uniloc*, 632 F.3d at 1320; *see also LaserDynamics*, 694 F.3d at 68; *Microchip*, 2020 WL 5203600, at *6.

Third, because Mr. Green concedes that TPUs are multi-component products, any royalty must be based on the SSPPU and not the value of the entire accused product. *LaserDynamics,* 694 F.3d at 67; *Uniloc*, 632 F.3d at 1318-20. No amount of apportionment can cure Mr. Green's fatal error of using the TPU systems as the SSPPU instead of TPU chips.

Microchip and *LaserDynamics* are instructive. In *Microchip*, the accused functionality related to the host-to-host capability on a chip that was part of a multi-component system—a media module for cars. *Microchip*, 2020 WL 5203600, at *6. The court held that the patentee's expert "was not permitted to use the [entire multi-component system] as the base for his cost-savings analysis," because the expert "***had to look at the cost savings at the chip level, not the device level***." *Id.* (emphasis added). The court noted that the patentee's expert did not explain how the accused intra-chip functionality created cost savings across the system as a whole, as opposed to at the chip or component level. *Id.* Similarly, in *LaserDynamics*, the accused functionality related to disc drives in a laptop computer. 694 F.3d at 68. The Federal Circuit found that the expert violated the entire market value rule by applying a two-percent royalty to total revenues from the defendant's laptop computer sales. *Id*. The court determined that the plaintiff failed "to present evidence showing that the patented [component or SSPPU] . . . drove demand for the laptop computers," and accordingly the expert's reliance on total laptop computer revenues for a royalty base was improper. *Id*. Although the expert had apportioned based on total sales, "the fact remain[ed] that the royalty was expressly calculated as a percentage of the entire market value of a laptop computer rather than a patent-practicing [component]." *Id*.

Nor can Mr. Green cure his failure to use the SSPPU to determine the royalty base by purporting to apportion out the numerous other components of a TPU system that are not accused of infringement. Not only is Mr. Green's apportionment analysis factually wrong, for the

reasons discussed above, it is also legally impermissible. When an expert chooses the wrong royalty base, that error infects the entire damages analysis—regardless of later attempts to apportion. *Microchip* and *LaserDynamics* both rejected attempts by the plaintiff's expert to correct their choice of an incorrect and highly misleading multi-component royalty base by apportioning out non-practicing components. *LaserDynamics*, 694 F.3d at 68; *Microchip*, 2020 WL 5203600, at *6. The rationale is simple:

> In any royalty analysis, there is a risk of awarding damages for non-patented features. The more non-patented features at play, the higher the risk. Narrowing the focus to the smallest patent-practicing unit mitigates that risk. **[An expert's] use of a cost-savings approach d[oes] not excuse him from that obligation.** In addition, by focusing on the [system], . . . [an expert] would raise the jury's eye level in a way that would create a risk of an unfair damages award.

Microchip, 2020 WL 5203600, at *6 (emphasis added). This concern is exactly why the Federal Circuit has "cautioned against reliance on the entire market value of the accused products" for multi-component systems. *VirnetX, Inc. v. Cisco Systems, Inc.,* 767 F.3d 1308, 1327 (Fed. Cir. 2014); *see also LaserDynamics*, 694 F.3d at 70 (noting that the SSPPU requirement ensures a reasonable royalty "does not overreach and encompass components not covered by the patent").

Here, Mr. Green's analysis suffers from the same incurable ailment identified in both *Microchip* and *LaserDynamics*: because Mr. Green has chosen a royalty base that is far beyond the SSPPU—let alone the accused functionality—Mr. Green's opinion is completely untethered from any cost-savings that could be attributable to the patented functionality. *See also Cornell Univ. v. Hewlett-Packard Co.*, 609 F. Supp. 2d 279, 288-89 (N.D.N.Y. 2009) (excluding patentee's expert testimony because, instead of choosing "the smallest salable infringing unit with close relation to the claimed invention," patentee "stuck to its guns, aiming for the highest royalty base" by improperly relying on "a royalty base claim encompassing a product with significant non-infringing components"). Singular is not entitled to a reasonable royalty that

captures significant benefits Google derives from the use of *non*-accused features of TPU systems.

Moreover, Mr. Green's analysis fails to address substantial evidence reflecting the limited value of the Asserted Claims—including documents comparing GPUs and TPUs at the chip level, all of which Mr. Green reviewed but simply chose to ignore. Those documents show that a GPU chip performs the same or better than a TPU chip on every chip-to-chip performance metric: Peak TeraFLOPS / Chip, TDP (Watts) / Chip, and Memory GB/s / Chip. *See, e.g.,* Ybarra Decl. Ex G at 620. And, as explained above and in numerous other documents in the record, a "[redacted]" *See, e.g.,* Ybarra Decl. Ex. H at 449 (emphasis added). Put another way, TPU ***systems*** outperform GPU ***systems*** because of, among other non-accused functionalities, scaling through Google's interconnects, i.e., the non-accused functionality that allows multiple chips to work on machine-learning models at the same time. Any purported difference between TPU and GPU performance exists at the ***system*** level, untethered to the Asserted Claims and Singular's purported invention. Mr. Green offers no explanation for his decision to ignore these chip-to-chip comparisons. And as explained, Mr. Green's deposition testimony—that he used systems because "chips are being run in systems and they're being run at scale"—fails to address that the TPU system is not the SSPPU. *See supra* at 1. (citing Green Tr. at 171:3-13).

For all of these reasons, Mr. Green's failure to use the TPU chip as the SSPPU is legally improper and renders his [redacted] damages model inadmissible.

B. Mr. Green's apportionment is unsupported and unreliable.

As explained above, Mr. Green's use of an inflated royalty base infects his entire analysis and cannot be corrected through apportionment. *LaserDynamics*, 694 F.3d at 68; *Microchip*, 2020 WL 5203600, at *6. But even if Mr. Green had used the correct SSPPU to derive his

royalty base, his opinion would still fail to satisfy "the essential requirement for reliability under Daubert"--i.e., "that the ultimate reasonable royalty award must be based on the incremental value that the patented invention adds to the end product. In short, apportionment." *Commonwealth Sci.*, 809 F.3d at 1301.

Mr. Green relies on two apportionment analyses: a "technical" apportionment and an "accounting" apportionment. Green Rpt. at 107. Both are unreliable, untethered to any evidence in this case, and highly prejudicial because of their speculative nature.

1. Mr. Green relies on Dr. Khatri's flawed technical opinion to quantify the economic value of the patented technology.

Dr. Khatri concludes that 40% of the value of the accused TPU ***systems*** is attributable to the Asserted Claims. Mr. Green does not conduct any further apportionment analysis, instead applying wholesale Dr. Khatri's 40% apportionment figure to calculate cost savings allegedly attributable to the Asserted Claims. *See* Green Tr. at 54:9-12 ("Q. The 40 percent apportionment rate, you got from Dr. Khatri, correct? A. Yes, that's a technical apportionment from Dr. Khatri."); Green Rpt. at 101. But Mr. Green's uncritical reliance on Dr. Khatri's analysis is unreliable for the reasons explained below.

First, where, as here, multi-component products are accused of infringement, technical apportionment requires isolating "only the value of the infringing features of an accused product." *Ericsson*, 773 F.3d at 1226. As explained in Google's concurrently filed motion to exclude certain of Dr. Khatri's opinions, Dr. Khatri fails to apply the relevant apportionment standard—or any apportionment standard at all. *See* Khatri *Daubert*, Section III.B. It is therefore unsurprising that, for the reasons discussed below and in Google's *Daubert* motion targeting his opinions, Dr. Khatri failed to use the appropriate standard in reaching the conclusion that 40% of the value of the accused TPU systems are attributable to the asserted claims.

Second, Dr. Khatri admitted that he was unaware of the IPR results that found certain claims unpatentable as obvious and certain elements in the Asserted Claims to have been known in the art.[7] *See* Khatri *Daubert* Section III.B. As a result, and unbeknownst to Dr. Khatri, the only arguable patented improvement of either of the Asserted Claims is the "exceeds limitation," *i.e.*, the requirement that the number of LPHDR execution units in an infringing device "exceeds by at least one hundred" the number of execution units in a device adapted to perform traditional or full-precision operations. *See* Section I, *supra.* But Dr. Khatri failed to isolate the *patentable* invention, because he does not identify—or even know—what has been found not patentable by the PTAB. Instead, Dr. Khatri "conflat[es] the patented technologies" with a multi-component invention not covered by the patent, an analytical sleight-of-hand "which should not [be] presented to the jury." *Apple Inc. v. Wi-LAN Inc*., 25 F.4th 960, 975 (Fed. Cir. 2022) (affirming grant of motion to exclude expert testimony).

Mr. Green's blind reliance on Dr. Khatri only compounds Dr. Khatri's error. At no point does Mr. Green rectify or account for this oversight in his own analysis. Both Mr. Green and Dr. Khatri ignore the numerous additional elements (including both conventional elements and Google's novel contributions) in these systems and chips instead of apportioning them out in their analysis. Due to this failure, both Mr. Green and Dr. Khatri dramatically overstate the value of Singular's purported invention. *See AstraZeneca AB v. Apotex Corp.*, 782 F.3d 1324, 1338-39 (Fed. Cir. 2015) (patentee entitled to compensation only for the value of its patent beyond that "conferred by the conventional elements alone"). Nevertheless, Mr. Green—relying on Dr.

[7] *See Intellectual Ventures I, LLC v. Lenovo Grp. Ltd.*, 370 F. Supp. 3d 251, 256 (D. Mass. 2019) ("[A] final judgment from the PTAB on the invalidity of a patent claim has an issue-preclusive effect on any pending actions involving that patent.").

Khatri—apportions only 60% of his royalty base to two features—interconnects and TensorFlow (an open-source software library for machine learning)-–ignoring all other unaccused features.

Because Mr. Green's analysis relies on Dr. Khatri's infirm technical apportionment opinion, Mr. Green's opinion is likewise unreliable and should be excluded.

2. Mr. Green's "accounting apportionment" is unsupported and unreliable.

Mr. Green's alternative "accounting apportionment" calculation fares no better. It relies on Google's TPU development costs to determine the value of the patented technology they allegedly use. *See* Green Rpt. at 101 (describing "the apportionment to the patented technology based on the overall investment to develop the accused TPUs"). As an initial matter, Mr. Green again premises this analysis on the TPU system instead of the TPU chip. He begins by purportedly looking at differences between the TPUv1 system—which is not accused of infringement—and the TPUv2 system—of which only certain parts are accused of infringement. Mr. Green admits that he does not have "documents that would enable [him] to identify the specific development costs related to the inclusion of the matrix multiply unit or the development of the interconnects," let alone all the other components of these highly complex systems. *Id.* at 104. Nevertheless, with no basis (either from Dr. Khatri, any depositions, or any document), Mr. Green states "it would be reasonable to allocate 50% of the development cost to the matrix multiply unit and the remainder to the interconnect[s]. Thus, 50% of TPUv2 development cost, or 23.4% of total development costs, would be apportioned to the patented technology." *Id.*

This analysis is unreliable under any standard. ***First,*** Mr. Green cavalierly assumes a 50% cost-allocation with no technical or factual basis, despite the fact that an increase or decrease of a single percentage point would have [redacted] in consequences with a [redacted] royalty base. ***Second***, as Mr. Green acknowledges, development costs are not indicative of the value of

any component of an invention and are therefore not a reliable basis upon which to apportion the value of the Asserted Claims. Green Tr. at 58:6-10 ("when we're looking at accounting analyses, when we're talking about cost, cost often enough does not necessarily reflect the value of a technology"). ***Finally***, Mr. Green's entire 23% accounting apportionment is "based on differences between the non-infringing alternatives ("NIAs") and the Accused Products." *Id.* Mr. Green thus admits that his analysis is tied entirely to NIAs, even though a proper analysis must be tied to "the incremental value that the ***patented invention*** adds to the end product."[8] *Commonwealth*, 809 F.3d at 1301 (emphasis added). Given that this analysis sidesteps the requisite consideration of the contribution of the patented invention in favor of simply tabulating related design costs, Mr. Green's accounting-based apportionment should be excluded.

C. Mr. Green arbitrarily allocates all cost savings to Singular.

Even if Mr. Green's apportionment analysis were proper, his opinion suffers from yet another fatal flaw: he assumes, without justification or explanation, that a reasonable royalty here based on cost savings would be equal to the amount that Google saved by virtue of the patented technology. His "Lump Sum Royalties" exhibits make this clear. *See* Green Rpt., Exs. C, F. But that assumption is "insupportable," both as a matter of "rudimentary economics and common sense." *Looksmart Grp., Inc. v. Microsoft Corp.*, No. 17-CV-04709, 2019 WL 4009263, at *3 (N.D. Cal. Aug. 5, 2019). A reasonable royalty analysis presumes that the parties act rationally. But no rational economic actor would engage in activity without benefit. Yet, that is exactly what Mr. Green assumes here: every penny that Google avoided in costs would go to Singular.

[8] Indeed, while Mr. Green acknowledges that the NIA he relies on–GPUs–have differences beyond those attributable to the patented invention, he makes no effort to isolate those features in his analysis. *See* Green Rpt. at 8-9 (describing GPUs and how they differ from TPUs).

In *Looksmart*, the court excluded an expert's opinion for relying on a substantively identical assumption. The same result is required here: Mr. Green's cost savings analysis and damages calculations, which fail to account for any return to Google, should be excluded.

D. Mr. Green's opinion that damages range [redacted] is too speculative to assist the jury and should be excluded.

In his report, Mr. Green opines that Google would have paid a "lump sum royalty payment of *as much as* [redacted]." Green Rpt. at 63 (emphasis added). At deposition, Mr. Green narrowed this range, providing a lower bound of [redacted]. Green Tr. at 49:7-10. But that still leaves a breathtaking range of [redacted] in potential damages.

Expert testimony must "help the trier of fact to understand the evidence or determine a fact in issue." Fed. R. Evid. 702(a). Remarkably wide ranges, such as Mr. Green's, "create[] a deceptive appearance of precision rather than the true picture of an enormous spread in 'value.'" *Ayers v. Robinson*, 887 F. Supp. 1049, 1063 (N.D. Ill. 1995). By Mr. Green's own admission, his analysis is designed "to provide the trier of fact with a range" and "provides the jury with an opportunity to consider the damages here could amount to as much as [redacted]"; but he will not tell the jury which end of his broad range is more likely. Green Tr. at 50:24-51:9. In other words, Mr. Green would give the jury damages options from [redacted] and allow it to decide which of these royalty numbers (or any amount in between) is correct. This opinion runs afoul of both Rule 702 and Rule 403. It should be excluded.

Mr. Green's opinions are particularly likely to cause improper speculation because he will not tell the jury which end of his broad range is more likely. For instance, in his report, Mr. Green considers hypothetical negotiations based on both contemporaneous projections of TPU usage and actual usage. But Mr. Green does not intend to identify which is the proper measure of damages: "I intend to describe both to the jury and enable them to evaluate the facts that they

believe to be relevant." Green Tr. 34:3-6. Allowing Mr. Green to present his divergent, indeterminate, and open-ended opinions to the jury will not assist it. To the contrary, ranges of [redacted] of dollars will serve only to confuse the jury, lead to improper speculation, and prejudice Google by infecting the jury with artificially large damages figures. *See SiOnyx*, 2019 WL 13180450 at *1 (citing Fed. R. Evid. 403). Mr. Green's opinion and testimony should be excluded in their entirety for these reasons as well.

E. Testimony parroting Singular's narrative of the case should be excluded.

In two different respects, Mr. Green's report and testimony veer outside of the parameters of expert testimony and into attorney argument. These sections should be excluded.

First, Section IV.C.3 of Mr. Green's expert report is titled "Overview of Relationship between Singular and Google (2011 – 2017)." In it, Mr. Green purports to provide a summary of the "relationship" between the parties prior to the hypothetical negotiation date. Green Rpt. at 27-34. But Mr. Green admittedly has no first-hand knowledge of that relationship. Green Tr. at 283:5-7. Instead, he simply parrots the narrative Singular intends to tell the jury.

Although Google will disprove Singular's story at trial, expert testimony is unnecessary to help the jury understand it. Section IV.C.3 contains no expert analysis, therefore the commentary within it should be excluded.[9] *See, e.g.*, *United Servs. Auto. Assoc. v. Wells Fargo Bank, N.A.*, 18-cv-00366-JRG-RSP, 2019 WL 6896674, *2-3 (E.D. Tex. Dec. 18, 2019) (excluding expert testimony regarding the parties' interactions because it "contains no expert analysis that would help the trier of fact to understand the evidence or to determine a fact").

Second, Mr. Green returns to the parties' "relationship" in discussing *Georgia-Pacific*

[9] Section IV.C.3 should also be excluded under Rule 403. *See Victaulic Co. v. ASC Engineered Sols., LLC*, 20-cv-887-GBW, 2022 WL 17250376, *7-8 (D. Del. Nov. 28, 2022) (excluding testimony under Rule 403 where party sought to "introduce factual evidence that may be introduced through other witnesses by way of an expert's testimony.").

Factor 5, which considers whether the parties would have been "competitors" or simply "inventor and promoter" at the time of the hypothetical negotiation. 318 F. Supp. at 1120. This testimony, too, should be excluded as it is speculative and impermissibly relates to Google's state of mind. Mr. Green concedes that the parties are not competitors and that such a relationship "generally results in a lower royalty rate." Green Rpt. at 92, 108. Mr. Green then opines that the parties' hypothetical negotiation would have defied this general rule because the parties' relationship prior to the negotiation demonstrated that Singular's technology "was significant to [Google's] business operations" and that "Google realized that its TPU program included technology that had been discussed with Google by Dr. Bates." *Id.* at 92, 108.

Mr. Green's opinion on this score should be excluded because it relies entirely on his speculative characterization of Google's state of mind, which "is not the proper subject of expert testimony." *OneBeacon Am. Ins. Co. v. Com. Union Assurance Co. of Can.*, 804 F. Supp. 2d 77, 85 (D. Mass. 2011), *aff'd*, 684 F.3d 237 (1st Cir. 2012). Although Singular's fact witnesses can tell the jury its version of the parties' pre-2017 relationship and the jury is free to reach its own conclusions as to Google's state of mind at the hypothetical negotiation, it is improper for Mr. Green to do so. *Holmes Grp., Inc. v. RPS Prods., Inc.,* No. 03-cv-40146-FDS, 2010 WL 7867756, *5 (D. Mass. June 25, 2010) ("An expert may not testify to another person's intent. No level of experience or expertise will make an expert witness a mind-reader.").

IV. CONCLUSION

For the reasons stated above, Google respectfully requests the Court to enter an Order to exclude the entirety of Mr. Philip Green's testimony.

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Respectfully submitted,

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